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Risks and Benefits with International Technology Transfer from Brazil to Angola

Riscos e Benefícios da Transferência Internacional de Tecnologia, do Brasil para Angola

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Abstract

Thanks to the transfer of technology from Brazil, Angola is entering the sucroalcooleiro sector with multiple aims. These include creating jobs in rural areas, diversifying the energy mix and boosting exports. Angola is one of the countries that has envisioned international technology transfer as a strategy to increase participation in the global market, while decreasing its dependence on sugar imports. While the production of ethanol and sugar can bring about some benefits, technology transfer in this area is not without risks. It needs to be carefully crafted and executed, especially in accordance with the principles of sustainable development, which is by the government plan of Angola to include, rather than exclude, the rural poor. This study shows that stakeholders presented different opinions in relation to Biocom and sustainable development. The main reason is linked to the distinction between global, national and local levels. On the global level, ITT and Biocom are seen as alternative renewable sources of energy (ethanol) to fossil fuels, on the local level there is a concern with the socio-environmental issues which local communities might face, indeed ITT and Biocom are perceived as a risk in case locals lose their lands and do not receive compensation. On the national level, while there is the expectancy of employment, infrastructure development and attraction of investments in the country, there is a lack of trust in governance by Angolan civil society; which argues that Angolan government and enterprises do not encourage public participation nor allows it to happen. Technology transfer is perceived as a business and geopolitical strategy driven by private and state interests, undermining environmental and social costs. On the other hand technology transfer is seen as a key to foster economic opportunities towards sustainable development.

Keywords: Sugar cane, International Technology Transfer, Governance, Cerrado, Sustainable Development.

Resumo

Graças à transferência de tecnologia do Brasil, Angola está entrando no setor sucroalcooleiro com múltiplos objectivos. Estes incluem a criação de emprego nas zonas rurais, diversificando a matriz energética e impulsionando as exportações. Angola é um dos países que previu a transferência de tecnologia internacional como uma estratégia para aumentar a participação no mercado global, diminuindo sua dependência das importações de açúcar. Enquanto a produção de etanol e açúcar pode trazer alguns benefícios, a transferência de tecnologia nesta área não é isenta de riscos. Ela precisa ser cuidadosamente elaborada e executada, especialmente em conformidade com os princípios do desenvolvimento sustentável, que está contemplado no plano do governo de Angola para incluir, em vez de excluir, o pobre rural. Este estudo mostra que as partes interessadas apresentaram opiniões diferentes em relação à Biocom e desenvolvimento sustentável. A principal razão está ligada à distinção entre os níveis global, nacional e local. No nível global, ITT e Biocom são vistos como fontes renováveis alternativas de energia (etanol) para os combustíveis fósseis, a nível local há uma preocupação com as questões socioambientais que as comunidades locais possam enfrentar, de fato ITT e Biocom são percebidos como um risco, no caso de os locais perderem suas terras e não receberem remuneração. No nível nacional, enquanto existe a expectativa de emprego, desenvolvimento de infraestrutura e atração de investimentos no país, há uma falta de confiança no governo pela sociedade civil angolana; que argumenta que o governo angolano e as empresas não incentivam a participação do público, nem permite que isso aconteça. A transferência de tecnologia é percebida como uma estratégia de negócios e geopolítica movida por interesses privados e estatais, renegando os custos ambientais e sociais. Por outro lado, a transferência de tecnologia é vista como um fator chave para promover oportunidades econômicas para o desenvolvimento sustentável.

Palavras-chave: Cana-de-açúcar, Transferência Internacional de Tecnologia, Governança, Cerrado, Desenvolvimento Sustentável.

Large-scale bioenergy initiatives are a contested site of discussion, especially in Africa, due to issues surrounding: food (in)security, biodiversity loss, water scarcity (Blottnitz and Curran 2006; Hooda and Rawat, 2005; Vanwey 2008; FAO 2008; IAAST, 2009), land competition, weak governance, (Fritsche et al., 2005; Mangoyana, 2009) and health impacts from fertilizers and deforestation (Martin, 2009; Vanwey, 2008). However, a series of South-South cooperation agreements have been established between Brazil and African countries. Some examples are in Libya, Morocco, Mozambique, Ghana, Kenya, Tunisia, Benin, Zambia, Malawi, Togo and Angola.

In 2007 Angola entered the list of African countries which opted to adopt the *sucroalcooleiro* (sugar cane/alcohol) know-how from Brazil. This agreement led to the creation of a

joint venture called BIOCOM (*Companhia de Bioenergia de Angola*) which facilitates the transfer of technology of *sucroalcooleiro* capabilities from Brazil to Angola. This technology transfer agreement between Angola and Brazil is an example of many emerging projects between Brazil and African countries, which aim to produce sugar and ethanol, for domestic and international markets.

BIOCOM is a registered Angolan company which was created as a joint venture between the state oil company in Angola called Sonangol (20%), an Angolan firm called Damer (40%), and a Brazilian firm called Odebrecht (40%). This initiative was launched mainly because of the efforts of the Angolan Agency of Private Investment (ANIP) to attract foreign investment to Angola, and the Brazilian Bank of Development (BNDES) providing funds to Odebrecht.

While Brazil seeks to expand its *sucroalcooleiro* technological capabilities through International Technology Transfer (ITT) under the argument that biofuel from sugar cane is clean, sustainable and efficient, other nations seek to offset their carbon emissions. Both cases drive investments in the bioenergy sector and are considered a geopolitical force linked to post Kyoto emission reduction (Chakauya, 2009: 178; Ojima et al., 2008 : 293; OECD 2007). Other many developing countries, especially in Africa, are eager to obtain Brazilian technological capabilities, which involve the adoption, implementation and management of *sucroalcooleiro* activities.

The UN Agenda 21 (1992) stands for the diffusion or acquisition of efficient technologies that allow developing countries to protect the environment, alleviate poverty and diversify the economy towards sustainable development (UN Agenda 21, 1992). This paper explores the dilemma on technology transfer and sustainable development being intrinsically connected.

Theoretical Background

Technology Transfer

Technology transfer stimulates productivity growth due to technological change and innovation of products and services, which opens new market opportunities (Hoekam and Maskus, 2005: 1587; Grossman & Helpman, 1991). Technology transfer involves two important processes: “The transfer of industrial production capacities, and the transfer of capabilities to master, adapt and further develop imported technology” (OECD, 1981: 12).

Technology transfers are also regarded as both the cause and consequence of changes in the world economy (OECD, 1981:73). The reasons for those changes are linked with the high industrial rates of growth, demand in industrialized countries and also market potentials in

developing countries (ibid). There are no coherent, overarching theories of technology transfer (Martinot et al., 1997). The term 'technology transfer' is conceptualized in different ways by different authors, depending on the view of technology as a commodity, as knowledge, or as a socio-economic process (Rosenberg, 1982).

Definitions on this topic are extensively encountered in the literature. In classical economics the view of technology is that a commodity can be reproduced and transmitted from one agent to another without costs, as "making a photocopy of design documents or obtaining a working artefact" (Martinot et al., 1997). In this view, technology is seen as a capital-commodity. Agenda 21 regards technology as knowledge (UN Agenda 21; see also Kranzberg M. 1986). Accordingly, it can also be viewed as a "quantum of knowledge retained by individual teams of specialized personnel" (Martinot et al., 1997), or the body of knowledge that is applicable to the production of goods (OECD, 1981). Thus, transfer is defined by Brooks, "as the process by which science and technology are diffused throughout human activity" (Brooks, 1966; see also OECD, 1981).

As for Besant and Rush (1993) technology transfer is a set of processes or activities throughout which a technology - embodied in goods or processes, or disembodied in knowledge, skills or legal rights - flows among different users. In this broader sense, technology is not only machines or a blueprint, but skills, abilities and knowledge. (Liggins and Robinson, 2005:62).

The term technology transfer is thus not only about the transfer of inanimate objects such as machines, but rather a process of learning, for instance Rosenberg and Frischtak (1985) advocate for a different use of the terminology; "*technology cooperation*"- in order to substitute what they call "the bankrupt notion that technology can be 'transferred' full-scale from one economic and cultural context to another" (Rosenberg and Frischtak 1985:19).

Schmidheiny (1992) argues that commercially beneficial cooperation between firms and organizations is at the core of successful technology transfer for sustainable development. In the same line, Rashed M. Al-Thawwad (2008) suggests that technology transfer allows technological capabilities (outcome of learning interaction between industry, university and research centers) to become "the" essential "ingredients" for sustainable development. The United Nations Conference on Environment and Development (Agenda 21) has linked technology transfer to sustainable development in chapter 34: "*New and efficient technologies will be essential to increase the capabilities (in particular of developing countries) towards sustainable development, sustain the world's economy, protect the environment, and alleviate poverty and human suffering" (Agenda 21).* Additionally, the principle nine stands for cooperation among states in order to improve

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scientific and technological knowledge, aiming at *enhancing the development, adaptation, diffusion and transfer of technologies (ibid.).*

The terms used above (diffusion, transfer, development, adaptation, application, cooperation and exchanges) are central to the process of ITT and relate to socioeconomic processes of technological change and learning (Martinot et al., 1997: 363). International technology transfer emerged as a "separate field of inquiry as a consequence of the accelerating awareness of the economic interdependence of nations and of the central role of technology in international relations" (Rashed, 2008: 3; see also McIntyre, J., and Papp, D. 1986**).** The role of UN's Agenda 21 is to communicate that a successful transfer of appropriate technologies is essential towards the goal of sustainable development. ITT is likely to contribute to community, regional and national development, in turn promoting sustainability in developing countries or transition economies, by adopting new and efficient technologies (Agenda 21).

Agent Perspectives

Agent/agenda perspectives consider the questions of "which agents are involved in technology transfers and why transfers take place" (Martinot et al., 1997: 366). Multinational corporations; national governments; and Non-governmental organizations are agents that are involved in the process of technology transfer in the study context of sugar-energy industry.

Different agents (i.e. Universities, research institutions, Non-Governmental organizations, United Nations agencies) are involved in the process of technology transfer. Multinational corporations are the dominant agent (Martinot et al, 1997: 366. Internationally technology flows are commanded by multinational corporations usually responsible for the transmission of capital and ideas across national borders. (McIntyre and Papp, 1986)

- *Multi-national Corporations*

Biocom is a joint initiative between Brazilian and Angolan Multinational Corporations (MNCs), which has joined efforts to launch Biocom Ltd in Angola. From a MNC perspective technology transfer is described as "a business processes not only a technical one" (Liggins and Robinson, 2005:63). Thus, this process is motivated by an organization which needs to generate or increase profit by exploring opportunities in the market (ibid.). Such opportunities demand license agreements or joint ventures which might share the risks and benefits involved in the process (ibid.).

For a MNC, technology transfer is seen as a reason to explore further capacities within a firm or organization, thus to use the transfer to fulfill their objectives: “1) gain, keep a market or have a market share; 2) obtain factors of production at a competitive and cheaper price through equipment transfers and foreign direct investment; 3) gain access to regular supplies of raw materials 4) maximize the use of assets which may not have profitable alternative uses.” (*OECD, 1981:20*). It is worth noting that the transfer of technology will therefore only take place when the interests of the enterprise so demand. (ibid.).

- *National Governments*

Governments which receive technology seek to increase technological capabilities by attracting foreign direct investment (FDI) (Martinot et al, 1997). Donor governments are thus likely to fund projects of technology transfer that support their political goals especially in terms of expanding international markets and to increase exports. Technology transfer enables developing countries to participate in the world industrial trading system, adapt and compete in the global economy (OECD, 1981:7). Maskus (2004) also finds in his studies that technology transfer becomes a critical issue in order to sustain economic transformation and sustainable growth.

Public and private actors from developed and developing countries seek to benefit from commodity markets by keeping pace with growing advances in technological progress (OECD , 2009:31). Governments search for investments and technological capabilities elsewhere (Zacchea, M ,1991). ITT can thus play a fundamental role to economic development, because it allows development of technological capabilities. Technology transfer is also tied to a range of other societal issues such as climate change mitigation by accomplishing environmental goals, which can allow more capital flow through market based incentives by governments (Martinot et al, 1997).

- *Non-governmental Organizations*

Market approaches that intend to solve socio-environmental problems and environmental impacts of technological transfer have been scrutinized by Non-governmental organizations (NGOs) (NRDC, 1994; see also Martinot et al., 1997). NGOs have been an important player in considering the “appropriateness” choices of technology for local realities and conditions (ibid.). It is thus expected that NGOs reports about social and cultural potential impacts related to technology transfer processes. Additionally, those institutions are in the front line on debates about the need of adaptation in order to minimize unwanted consequences (see next section).

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Sustainable Development

Those externalities, costs and benefits are approached in this paper as "environmental and socio-economic consequences" of bioenergy initiatives, especially related to Brazilian *sucroalcooleiro* sector and new technology transfer initiatives in Sub Saharan Africa. In the beginning of this section ITT was portrayed (UN Agenda 21) as a way forward to sustainable development, thus a brief review on the concept (SD) and its relation to technology transfer and bioenergy systems is indispensable.

As a programme to resolve socio - environmental problems sustainable development is defined as: "The development which meets the needs of the present generations without compromising the ability of future generations to meet their needs" (WCED 1987: 9). Hence the most common definition of sustainable development gives attention to the integration of the environment into economic development and in the process of decision making (Elliott, 2007:35). The UN division for sustainable development claimed that states and people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for SD. Thus, disparities in standards of living are expected to decrease and better meet the needs of the majority of the people in the world (UN, 1992).

Sustainable development in Sub Saharan Africa faces many challenges; given agricultural low yields and widespread poverty, hunger and malnutrition, demand for agricultural intensification is paramount in spite of a range of obstacles (IAASTD: 8). One of the obstacles which the region faces is a lack of technological capabilities (Muchi et al., 2003; FAO, 2008). The term technology capabilities refer to "the effort to use technological knowledge" (Kim, 1997:4). According to Agenda 21(United Nations, 1992), the diffusion or acquisition of efficient technologies allow developing countries to protect the environment, alleviate poverty and diversify the economy, being essential to sustainable development. Therefore, it is important to acknowledge that ITT and SD discourses alike portray that there is an intrinsic relationship between technology transfer and sustainable development.

On the other hand, studies have shown that large scale biofuels projects which depend on technological capabilities or ITT face a range of sustainability issues: pressure on food prices, land competition, limitation on benefits for local communities, depletion of natural resources, etc. (IAAST 2008; FAO 2008, Vanwey , 2008; Ojima , 2008; Mangoyana 2009; Blottnitz and Curran 2006; Hooda and Rawat, 2005).

Methodology

This study utilizes a qualitative methodology based on interviews with key stakeholders from different institutions[1] and desktop research including document analyses such as several articles, books, reports and online sources. This study seeks to qualitatively examine the perceptions of Biocom held by direct and indirect stakeholders, and recognize that these perceptions depend on social and cultural contexts (Limb, 2004). The *sucroalcooleiro* project will not be fully operational until 2012 so its actual and material consequences cannot be calculated yet. Judging its successes and failures in terms of sustainability outcomes is therefore not possible.

Interviewee 1	Embrapa (Brazilian Enterprise for Agricultural Research)
Interviewee 2	Researcher and Administration (Unicamp)
Interviewee 3	Cosan ltd. – Industry Sugar and Ethanol
Interviewee 4	Representative from the Ministry of Angola
Interviewee 5	ADRA – NGO in Angola
Interviewee 6	Biocom- Agribusiness Manager
Interviewee 7	BNDES
Interviewee 8	Consultant in Development (worked for DFID UK
Interviewee 9	Worked for ADRA

Apart from the field work in Brazil and Angola (phone, emails), I had a chance to interview an important actor from BNDES (Brazilian Bank of Development) during the COP15 (United Nations Conference on Climate Change) held in Copenhagen. Also, during side events other observations were made, especially in the Brazilian delegation hall, and informal talks with the Ministry of Angola. The last field work assisted this study to be more consistent, and recognize the complexity of different perceptions in the sugar cane industry, and the role of technology transfer.

Biocom which is an organization that aims to bring a new sugar-energy technology to Angola is approached as a representative or “exemplifying” case study. Therefore, it is important to acknowledge that this study does not quantify the impacts of a technology, but it examines the perception of different stakeholders in relation to a technology transfer project in regards to sustainability.

Influenced by the literature in various cases of bioenergy systems in Brazil and Sub Saharan Africa, the reasons to choose this case was three fold 1) an interesting example of a technology transfer project South-South 2) Angola being a colony of Portugal (portuguese language) facilitates the language barriers which could be encountered in other countries 3) Interesting to look at an ongoing projects in the stages of implementation, allowing researchers and policy makers to perceive “science and technology in context, aiming to better shape and control its

results" (Hackett, 2007). Also, open debate on the field of policies not only in Angola, but in other regions which intends to acquire new sugar-energy technologies.

Analysis

The agribusiness manager from Biocom clarified that ANIP (National Agency for Private Investment) was a key driver for Biocom to be launched as a joint venture between companies from Brazil and Angola. "*A key point for the initiative (Biocom) became a reality as a result of the mechanisms for* attracting investment from the Government of Angola"(ANIP)(Interviewee 6). This statement is related to the work of ANIP, in charge of raising funds for private investments. In the case of Biocom, it was argued that most of the initial funding came from the Angolan Foment Bank (BFA) and Bank Espírito Santo (BESA), with the participation of Brazil's State Development Bank (BNDES). An interview with the head of the environmental department of policies of BNDES confirmed that the Bank (BNDES) contributed to this project. In addition, the role of the government in promoting Angola as an attractive country for foreign direct investment became clear after an informal talk with a representative from the Angolan ministry during the UN Climate Change Conference 2009 (COP15). "*we need to invest more in agriculture, attract more foreign investments and bring expertise from others to boost agribusiness"* (Interviewee 4*)*

The work the embassy from Angola is doing around the world is to contact different firms and governments in order to cooperate and attract investment. (Interviewee 4) When asked about the technology transfer projects, he said: "*we do not mind where the technology comes from, or the expertise…" we are interested in getting where the others are..."* (Interviewee 4).

Technology transfer is seen in this project as an opportunity of expansion and economic development for Angola. Also, it is believed that the country's economy can become more diversified and rely less on oil and diamond. The entry of new and efficient technologies is regarded as means toward sustainable development. Technology transfer is seen as very important to "stretch friendships" in business, in turn promoting economic opportunities for the industry (Interviewee 3). Also, this process can be beneficial for commercial activities between firms (ibid.). As the process of technology transfer is seen as a means towards firm's interrelations, technology itself (embodied knowledge) is considered of 100% importance for Biocom initiative to happen.

If we did not have prior knowledge of what happened in Brazil, certainly we would not have started the project, maybe that's why even though many have known the place (Angola - Cacuso), nobody have seen the potential." (Interviewee 6). This view conveys that an opportunity

which promotes economic development is always available, but in fact relatively dependent on technological diffusion.

Brazilian expertise in the areas of agricultural practices, genetics and industrial equipment comprise the main elements of Biocom's technology transfer initiative. (Interviewee 6). This technology is seen by Burgus to ensure efficient, sustainable, sucroalcooleiro state-of-the-art production. In terms of good practices, the project is meant to focus, among other, on water and waste management (including recycling) and fertilizer use efficiency (Interviewee 6). Burgus confirms that most of the technological competence that is being transferred to Biocom is already of public domain, but some are protected knowledge by ETH Odebrecht.

While in Brazil, I interviewed some actors which did not want to be identified, one of them informed clearly what Brazilian enterprises in the bioenergy sector is seeking for.

"There is not a choice between sugar cane for ethanol or something else" We have what we have, and we are interested in expanding our technology, expertise and open international markets around the world" (Interviewee 2). When discussing social issues (i.e. rising in food prices), he claims: "we want food prices to be high; Brazil is an export country and it is positive for the economy to have high prices of foods in the global market" (interviewee 2). On the same topic: "A commodity cannot only be environmental and social sustainable, it must be economically feasible" (Interviewee 3). The first sentence shows that the geopolitical goal of exporting technological capabilities developed in thirty years can be seen as a target of Brazilian policy. Another argument that would explain this argument is related to duty-free tariffs from EU when exporting commodities from African countries. Ethanol and sugar have high tariffs from Brazilan companies, and from the interview above, one can see illustrated that perhaps by transferring technology and production to African countries, economic costs could be reduced. This would give the possibility for increased competition in the world market. It seems that the economical dimension of Sustainability is prioritized over the environmental and social. This is due to primary concern by firms of being economically competitive in the global market. However, in the case of this initiative, Burgus says: "Sustainability is a complete concept that involves economic, social and environmental aspects. The area where the project is taking place is an empty space in relation to population, and the few people in the surroundings has been involved the process of technology transfer, some participating in the building capacity within the company, others being trained in Brazil"

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The relation between this view and other stakeholders view regarding socio- environmental issues in relation to this initiative is presented in the following subsection.

Food Security

The topic on food vs. fuel was brought during the interviews, and opinions were diverging. First, it was discussed that if the deployment of sugar cane production is well planned the dilemma food vs. fuel is not a problem. Abel argues that the bagasse (waste) could be used for animal feed (i.e. cattle) and the area of sugar cane rotation (20% of total area) can be used for food production, especially vegetables (bean, soybean, peanut etc). Cane rotation means that sugar cane is substituted for other crops within each five years. In the specific case, Biocom intends to use sugar cane to produce sugar at first and ethanol, besides using the waste to generate electricity.

On the other hand, Katiavala (Interviewee 9) raises concerns that Angola is likely to face challenges in how to produce biofuels and sugar without compromising nutrition and food security of local communities. Katiavala says that "biofuels may compete with food production because it will involve the use of vast areas of land, many which used by local farmers. He intends to pursue debates with other organizations and civil society aiming at monitoring public policies and government targets for food security.

The joint venture Biocom's agribusiness manager has a different view from the previous one. The question of whether or not this initiative on technology transfer might compromise land and food security in the region was answered in this way: "The dichotomy between the production of biofuel and food is a fallacy in the tropics, especially in countries that have a low occupancy rate of agricultural areas such as Angola, where both products are extracted at the same time." (Interviewee 6). He argues that who defines what to produce in an area is not a farmer or the government, but the market price for certain commodities.

Land Competition

Previously discussed, the issue of including the poor rather than excluding is a theme that was often debated during the interviews. The question of displacement was addressed to different actors in order to examine the relation between land use and Biocom initiative. The first interview emphasized that land in Angola is not as available as it is portrayed by agribusinesses. "It is worrisome that the best land will be likely taken by the government to introduce monoculture for sugar and ethanol" (Interviewee 5).

On the one hand the phenomena of land grabbing was addressed by one stakeholder, and on the other Burgus from Biocom emphasized that this initiative has not appropriated land by any

community. In addition, Burgus maintains that there was integration of local people from Cacuso in the technology transfer process. Additionally, jobs have already been created for local people (Interviewee 6).

Among the benefits mentioned above, Joao indicates that the risks of this initiative are linked with this trickle down approach, which have been failing for a long time in promoting pro-poor development (Interviewee 8). He is concerned that investments in large scale businesses might help the poor, but unfortunately it has not yet being as positive as it should be. Joao points out that, certainly the idea that land is extensile available in Angola will put pressures on the poor, and there is a need for a participatory bottom up approach (Interviewee 8).

During another interview, with Biocom - Burgus claims that the knowledge and expertise from Brazil will allow Biocom to follow the best environmental management practices which is the most suitable for Angola. Thus, subsequent questions were addressed in order to examine the area in which Biocom is acquiring and the relation to biodiversity loss. The geographical area is seen as an empty and unused space (Interviewee 6). The results show that Biocom is an eager to explore those "unused and empty" lands, but also seeking sustainability practices. The conversion of the grassland ecosystem in sugar cane plantation is not seen as a jeopardy to the environment, because "there is nothing much than some grassland areas in the land we have acquired", and it is far from the road where some inhabitants are living (Burgus). It seems that there are tensions on different opinions in regards to socio- environmental sustainability of such initiative on technology transfer. All of them have to be taken in account in order to understand how socio-environmental issues have been perceived from different stakeholders.

Discussion

With regards to the first objective of the paper, the interaction among ANIP, Biocom and BNDES was the major driver legitimizing this joint venture, allowing the technology transfer process to be launched. Strategically, the government of Angola has situated ANIP as the base institution to attract FDI, seeking to diversify the economy and promote sustainable development. Therefore, as Odebrecth has engaged in the sector of biofuels in 2007 by lunching ETH bioenergia company, its strategy of expansion triggered the organization to seek new possibilities in expanding its technology expertise. Coincidentally or not, agriculture has been a sector of policy focus in Angola; thus Biocom initiative was in favourable circumstances.

The objectives of this initiative are interpreted differently depending on the stakeholders' perspective: on one hand, this initiative is expected to fullfil some sustainability criteria; but certain doubts exist surrounding the participation, transparency, and future socio-environmental benefits of the immersion of *sucroalcooleiro* industry in Angola. Those doubts are associated to the uncertainty of revenue distribution and social cohesion, being a challenge of sustainable development, even though technological transfer is seen as a key to foster economic opportunities towards SD. As technology transfer is perceived as a business and geopolitical strategy driven by private and state interests, there is a risk that environmental and social costs will be underestimated.

One explanation to address the complexity of sustainable development and socio-environmental changes in relation to this technology transfer initiative would be to look at the relation among global, national and local levels. On the global level, the project is perceived to bring a renewable energy industry[4] which will supply an alternative energy source, besides fossil fuels. However, this energy source seems to be intended for EU markets, which will increasingly demand more in the next years. On the other hand, on the national level it creates opportunities for internal markets for sugar and ethanol, creating national revenues in forms of taxation. On the local level (municipality of Cacuso), employment and modernization of the rural economy can be seen as important. However, there are several concerns with the sustainability of local communities which are perceived as in risk of losing their lands, and being restricted to access of vast areas where they depend upon to collect resources for their livelihoods. If social and environmental issues are to be ignored, (i.e. Participation in decision making) it is likely to lead to unsustainable development of the region (Fritsche et al., 2005; Mangoyana, 2009).

That said, an ideal sustainable development considered by some stakeholders is not seen as plausible to others. Harrison (2004) argues that sustainable development can be understood as an evolving process "which social and political institutions continuously adapt to changes in scientific knowledge, social values and ethical concerns".

The role of technology transfer in allowing "new and efficient technologies to increase the capabilities (in particular of developing countries) towards sustainable development, sustain the world's economy, protect the environment, and alleviate poverty and human suffering seems to be in contradiction to some stakeholder's perception" (UN Agenda 21). Agenda 21 which was written in 1992 still shares the same political beliefs and values of Biocom which argues that technology transfer aims to achieve those three goals. On the other hand, both Biocom and Agenda 21 seem to underestimate the drawbacks which new technologies can bring about, by not addressing it more

carefully. This is the view of several stakeholders which argue that indirect impacts can turn to be negative for some actors, and in jeopardy of non-compensation.

Conclusions

This paper aimed to approach the literature on international technology transfer in order to highlight the role of actors and institutions in the development of Biocom. ITT literature allowed this study to show that private interests and FDI[3] are drivers for Angola and other countries "lagging behind" in technology expertise and capabilities, to enter the sector of bioenergy systems, in this case *sucroalcooleiro* sector. Technology transfer is seen as a complex process which brings about economic development, protects the environment and reduces poverty and human suffering. On the other hand, other sources[4] reflect a deeper and more integrated understanding on what role ITT can play. It showed that some stakeholders observed this process as a potential threat to poor communities, which can overlook socio-environmental costs. Interviews highlighted environmental and socio-economic issues regarded in the literature of bioenergy systems:

- Potential for industrial activities and rural employment
- Technological capabilities and expansion of knowledge and education
- Opportunities for South - South cooperation among enterprises
- Land conflicts related to large scale *sucroalcooleiro* production
- Water, soil degradation and loss of biodiversity
- Lack of participation and weak governance

If the process of technology transfer does not account socio-environmental changes in local levels with the introduction of new technologies (i.e. *sucroalcooleiro*) Angola and other African countries can risk being a resource outlet for industrialized food and biofuel systems, with minimal considerations to fairness and ethical concerns. In this specific case of Biocom, it is too early to assume more than what stakeholders have perceived so far.

Technology transfer has to be carefully designed and executed, especially in countries characterised by weak institutional governance such Angola. This should be done in order to ensure economic development, with social inclusion of the most in need, and environmental protection (UN Agenda 21). The role of technology transfer portrayed by United Nations (Agenda 21) is to be fulfilled if the commodity to be produced - in this case sugar and ethanol – takes into account all

sustainability dimensions. Otherwise, the product could be in jeopardy, according to sustainability triple dimensions. This would not be in the interest of any of the stakeholders involved.

Overall, there is a need for a deeper understanding of the dynamics of technology transfer in relation to large scale bioenergy projects, especially South-South ITT cooperation such as the Biocom initiative. Such an understanding could help in the design of relevant policies to support rural activities and livelihoods, enhancing opportunities for majority of the population.

Notas

[1] research centres, academic institutes, multinational corporations, NGO
[2] Ethanol produced by sugar cane
[3] Foreign direct investment
[4] Literature on agriculture, sustainability and bioenergy systems (addressing socio-environmental issues)

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